PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2000-107758
(43)Date of publication of application : 18.04.2000

---

(51)Int.Cl.

C02F 1/44
B01D 63/02
B01D 69/12
B01D 71/26
G21F 9/06

---

(21)Application number : 10-284556
(22)Date of filing : 06.10.1998

(71)Applicant : MITSUBISHI RAYON CO LTD
(72)Inventor : YOSHIDA TAKESHI
KATO OSAMI

---

(54) TREATMENT OF CONDENSED WATER AND HOLLOW FIBER MEMBRANE MODULE FOR TREATING CONDENSED WATER

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a condensed water treatment method and a hollow fiber membrane module for treating condensed water large in the treatment quantity of water, good in condensed water purifying capacity, reduced in a change in the treatment quantity of water with the elapse of time, enabling long-term stable operation and capable of performing treatment in a conserved space.

SOLUTION: In a condensed water treatment method using a hollow fiber membrane module containing hollow fiber membranes, as each of the hollow fiber membranes, a composite microporous hollow fiber membrane characterized by that three or more layers membranes made of a polyolefin having a three- dimensional structure having a large number of micro-pores formed from stacked lamellae and microfibrils bonded to stacked lamellae are laminated and the innermost and outermost layers thereof are support layers and the intermediate layer held between both layers is a dense layer having an average pore size smaller than that of micro-pores of the support layers is used.

LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

* NOTICES *

JPO and NCIPI are not responsible for any damages caused by the use of this translation.

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the art of condensation and the hollow fiber module for condensation processing which are generated in a nuclear power plant, a thermal power station, etc.
[0002]
[Description of the Prior Art] Conventionally, the precoat filter made of ion exchange resin has been used for purification processing of the condensation generated in a nuclear power plant, a thermal power station, etc. However, the precoat filter made of ion exchange resin had the short life, and especially the pre call filter after processing the condensation tinctured with the activity generated in a nuclear power plant had the trouble of having to put and save in a drum. Therefore, a life is long, it can destroy for processing of the latest condensation by fire after filtration processing of condensation, and the porosity hollow fiber made from polyolefine is increasingly used for it as a film material which has the property of being able to control generating of secondary trash.
[0003] As a typical thing of the hollow fiber for hollow fiber modules used for processing of condensation, to JP,57-66114,A The laminating of the slit-like micropore formed in the thickness direction of the microfibril which carried out orientation in the direction of a major axis of a hollow fiber, and the film of a hollow fiber from a pars tuberalis with the stacked lamellae which carried out orientation is carried out into the membranous wall of a hollow fiber. And it has penetrated toward other front faces from one membranous front face, and the fine porosity hollow fiber made from polyethylene which forms the uniform fine vesicular structure in the thickness direction is indicated.
[0004] This hollow fiber carries out melting size enlargement of the polyethylene, and is manufactured by extending this size enlargement object further. That is, while performing annealing treatment, making a lamellae laminating crystal (stacked lamellae) form in the membranous wall of a size enlargement object, extending this size enlargement object subsequently and making between this stacked lamellae exfoliate after carrying out size enlargement of the polyethylene on specific spinning conditions, the fine porous membrane which has the above-mentioned specific structure is formed by growing up the fibril which connects between lamellae laminating crystals. Since this film has the above-mentioned specific fine vesicular structure, it is excellent in the mechanical strength and a solvent moreover is not used for it in that manufacture process, it has the description that little fear of mixing of the impurity to purification water is.
[0005]
[Problem(s) to be Solved by the Invention] However, since the hollow fiber made from polyolefine was hydrophobic film, when it used these hollow fibers for processing of condensation, it needed to perform hydrophilization processing by alcohol etc. As a hollow fiber which improves this difficulty, the thing which covered the hollow fiber made from polyolefine with the ethylene-polyvinyl alcohol copolymer, or the hollow fiber manufactured using the polyolefin resin which blended the ethylene-polyvinyl alcohol copolymer is known (JP,6-96102,B). However, although the fall of the amount of water penetration according [this hollow fiber] to crushing of micropore and blinding with time could be

prevented, the lowness of the amount of water penetration peculiar to a fine porosity hollow fiber has not improved. Therefore, although there was little aging of quantity of water to be treated, there was a trouble that quantity of water to be treated could not be made [many] in the art of the condensation using this hollow fiber.

[0006] What is necessary is to make the arrangement number of a hollow fiber increase, or just to lengthen the die length of a hollow fiber, in order to make the amount of water penetration per hollow fiber module increase. However, the amount of water penetration was not able to be made to increase in proportion to [although until increases the amount of water penetration in proportion / to some extent / to an arrangement number when the arrangement consistency of a hollow fiber is made to increase, if an installation consistency becomes above high to some extent, since passage resistance of the condensation to the center section of the hollow fiber bundle will become large] an arrangement number. Moreover, although the amount of water penetration increases, a certain die length was able to become rate-limiting, and the passage resistance inside a hollow fiber was not able to make the amount of water penetration increase from the relation between the bore of a hollow fiber, and the membranous engine performance to it in proportion to die length above a certain die length, also when the die length of a hollow fiber is lengthened and a film surface product is made to increase.

[0007] Although how to choose the big thing of a micropore aperture from the hollow fiber mentioned above as an option which increases the amount of water penetration can be considered, since the fractionation engine performance of a hollow fiber becomes less enough, the purification water of desired water quality is not obtained. Moreover, although the amount of water penetration increased even if it used the thin hollow fiber of thickness, it became the inclination which runs short of the mechanical strengths of a fine porosity hollow fiber in that case, it was stabilized for a long period of time, and condensation was not able to be processed. Therefore, for processing a lot of condensation, many large-sized hollow fiber modules needed to be used, and there was a problem that a large processing tooth space was needed.

[0008] Thus, quantity of water to be treated was large to processing of the condensation in a nuclear power plant, a thermal power station, etc., and the purification engine performance of condensation was good to it, it had little aging of quantity of water to be treated, and the art which is stabilized for a long period of time, and can process by space-saving was needed for it. And permeable ability (flux) is high, in such an art, it has the high fractionation engine performance which can remove a clad particle, it cannot carry out blinding easily at it, and it was hard to receive damage by the clad, and there were few differential pressure rises at the time of filtration, and the hollow fiber which has a mechanical strength (endurance) required to perform a miniaturization, raise in a life, reverse washing, bubbling, chemical washing, etc. was needed.

[0009] So, the art of the condensation using the fine porosity hollow fiber made from polyolefine of the two-layer structure by which the fine porosity hollow fiber which has micropore only with a bigger predetermined ratio than it was joined to the fine porosity hollow fiber which has the micropore which can separate the particle of a predetermined particle size is indicated by JP,9-108671,A. The fine porosity hollow fiber used by this art Bear the compact layer (inner layer) and reinforcement function of the diameter of a stoma which bears the fractionation engine performance, and the amount of water penetration is large. And being the bipolar membrane which consists of reinforcement stratum functionale (outer layer) of the diameter of an osculum which cannot carry out blinding easily, and maintaining the fractionation engine performance in which clad removal is possible compared with the hollow fiber (homogeneous membrane) of the conventional isomerism drawing engine performance, excel in blinding-proof nature, and while forming a high life Miniaturization of a cartridge was possible by reducing the film surface product which can obtain permeable high ability and is used.

[0010] However, the art of the condensation which uses this fine porosity hollow fiber had the good purification engine performance of condensation, and although there was little aging of quantity of water to be treated and it could process by being stabilized for a long period of time, quantity of water to be treated needed the large processing tooth space rather than was yet enough. therefore -- while maintaining the above-mentioned engine performance to the hollow fiber used for condensation

processing -- in addition -- and it is anxious for attaining much more high water penetration quantification and miniaturization by raising the permeable ability (flux) of a hollow fiber further.
[0011] Therefore, the purpose of this invention is to offer the art of the condensation which quantity of water to be treated can be large, the purification engine performance of condensation can be good, and there can be little aging of quantity of water to be treated, and is stabilized for a long period of time, and can operate, and can process by space-saving. Moreover, it is in offering the art of the condensation which can control the amount of the trash generated after processing of condensation. Moreover, permeable ability and the fractionation engine performance are high, and it is hard to carry out blinding, and is in offering the hollow fiber module for condensation processing excellent in a mechanical strength and endurance.
[0012]
[Means for Solving the Problem] The result which took lessons from development of the porosity hollow fiber used for the highly efficient hollow fiber module which this invention person etc. is the purpose which solves the above-mentioned technical problem, and fitted processing of condensation and which was inquired wholeheartedly, By considering as the configuration of the compound fine porosity hollow fiber by which the fine porous membrane (supporters) which has micropore only with a bigger predetermined ratio than it was joined to the fine porous membrane (compact layer) which has the micropore which can separate the particle of a predetermined particle size While few compound porosity hollow fibers of a fall of the membranous amount of water penetration are obtained irrespective of expansion of thickness Furthermore, by making a compact layer location into an interlayer, i.e., 3 layer structures inserted into the compact layer by supporters, in consideration of the location of the compact layer which bears the isolation in a compound porosity hollow fiber The conventional homogeneous membrane came to complete a header and this invention for the ability of the hollow fiber module with which the amount of water penetration increases further to be manufactured compared with the compact layer inner layer-ized compound hollow fiber from the first, maintaining the engine performance which is excellent in blinding-proof nature.
[0013] The art of the condensation of this invention is an approach of processing condensation using the hollow fiber module containing a hollow fiber. Namely, as said hollow fiber It comes to carry out the three or more layer laminating of the film of the three-dimensional structure made from polyolefine which has two or more micropores formed of the microfibril combined with stacked lamellae and this stacked lamellae. The innermost layer and outermost layer are supporters, and the interlayer inserted among these is characterized by using the compound fine porosity hollow fiber whose average aperture of micropore is a compact layer smaller than the average aperture of supporters' micropore.
[0014] Moreover, said supporters are thicker than a compact layer, these supporters' much more thickness is 20-50 micrometers, and, as for the void content of the whole film of said hollow fiber, it is desirable that it is more than 75vol%. Moreover, as for said hollow fiber, it is desirable to have been covered with the hydrophilic giant molecule and for microfibril to have banded two or more [at a time] together. moreover, a ratio with the mean distance [as opposed to / the amount of covering by said hydrophilic macromolecule is 3 - 30 % of the weight to the hollow fiber before covering, and / the mean distance Da between the microfibril bundles of the compact layer after covering] Db between supporters' microfibril bundles -- as for Db/Da, it is desirable that it is in the range of 1.3-4.0. Moreover, the hollow fiber module for condensation processing of this invention It is a hollow fiber module for condensation processing containing a hollow fiber. Said hollow fiber Stacked lamellae, It comes to carry out the three or more layer laminating of the film of the three-dimensional structure made from polyolefine which has two or more micropores formed of the microfibril combined with this stacked lamellae. The innermost layer and outermost layer are supporters, and the interlayer inserted among these is characterized by the average aperture of micropore being a compact layer smaller than the average aperture of supporters' micropore.
[0015]
[Embodiment of the Invention] Although the hollow fiber module used for the art of the condensation of this invention has the typical thing of the gestalt which a potting agent comes to fix to the catchment

section in the both ends of the hollow fiber which converged in the shape of U character including the hollow fiber as a filtration membrane, the gestalt may be what kind of thing.

[0016] Drawing 1 is the type section Fig. showing an example of the hollow fiber module used for the art of the condensation of this invention. A structural member 1 is a tube-like and has the openings 1b and 1b which carry out opening in the vertical direction in drawing. It is inserted from one opening 1b of a structural member 1, and that edge 3a converges, is fixed [it is turned up in the shape of U character, and] by the holddown member 2 with which it filled up in this structural member 1, and the compound fine porosity hollow fiber 3 (it is written as a hollow fiber 3 below) is attached in this structural member 1. An opening condition is maintained and, as for edge 3a of this hollow fiber 3, ****** 1a is formed of these edge 3a and said holddown members 2.

[0017] The cross-section configuration where the structural member 1 was cut to an others and opening aspect and a parallel direction is used for a rectangular thing etc., and the configuration is not limited. [shape / of a tube] Moreover, the peripheral face can be made into various configurations corresponding to the configuration of the installation location of a hollow fiber module. A holddown member 2 stiffens liquefied resin, such as an epoxy resin, an unsaturated polyester resin, and polyurethane, and is usually formed. A hollow fiber 3 allots what closed the end, for example in the shape of a straight line, and it is in the condition which maintained the opening condition of the other-end section, and it can converge and fix to a structural member 1, and it can also attach it in it.

[0018] When performing OUT->IN filtration in this hollow fiber module, a processed liquid is penetrated in a hollow fiber 3 from the front face of a hollow fiber 3. And it moves in the inside of a hollow fiber 3, and filtrate is discharged from edge 3a of the opening condition which constitutes ****** 1a. the processed liquid supplied to the front face of a hollow fiber 3 at this time, and the filtrate discharged from edge 3a -- a holddown member 2 -- liquid -- it is divided densely. When performing IN->OUT filtration, a processed liquid is supplied to ****** 1a, from edge 3a which constitutes this ****** 1a, a processed liquid enters in a hollow fiber 3, and penetrates a hollow fiber 3, and filtrate is discharged.

[0019] It came to carry out the three or more layer laminating of the film of the three-dimensional structure which has two or more micropores formed of the microfibril combined with stacked lamellae and this stacked lamellae, and the compound fine porosity hollow fiber (it is written as a hollow fiber below) used for the art of the condensation of this invention is equipped with a compact layer and supporters with the larger average aperture of micropore than said compact layer. It comes to form much micropores by extending the hollow fiber which is not extended [in which said compact layer and said supporters did spinning]. That is, by performing extension processing, stress concentrates on a structurally weak amorphous part, an amorphous chain develops in the extension direction alternatively, cleavage arises between stacked lamellaes, a part of stacked lamellae exfoliates in coincidence, these gather to the non-extended hollow fiber which carried out melt spinning, and microfibril is formed in it. And as a part with the strong cohesive force in the inside of stacked lamellae bears stress where the structure is held, and shown in drawing 2 , the slit-like micropores 22 and 22 and -- are formed between the pars tuberalises of the microfibrils 20 and 20 of a large number which accompanied in the extension direction, --, the stacked lamellaes 18 and 18 which this has combined and --.

[0020] The aperture of micropore 22, i.e., magnitude, is expressed by two parameters, the average value of die-length (it is equivalent to die-length [of the long side of the slit-like micropore 22], or distance between stacked lamellaes 18) L of microfibril 20, and the average value of the microfibril spacing W. In filtration by the hollow fiber, the amount of water penetration increases, so that the amount of water penetration mainly has long microfibril 20 depending on die-length L of microfibril. On the other hand, mainly depending on the spacing W of microfibril, the fractionation engine performance can raise the fractionation engine performance, so that the microfibril spacing W is narrow.

[0021] This hollow fiber raises the fractionation engine performance by the compact layer which has comparatively small micropore. And by the supporters who have comparatively big micropore, film reinforcement is raised and the amount of water penetration is raised. Therefore, in the hollow fiber module using this hollow fiber, a high transparency flow rate, the high fractionation engine

performance, and high endurance are acquired.
[0022] In a compact layer, the average microfibril length has desirable 0.2-5 micrometers, and average microfibril spacing has desirable 0.02-0.3 micrometers. Microfibril length is less than 0.2 micrometers, or the filtration resistance of a compact layer becomes it large that microfibril spacing is less than 0.02 micrometers, and the amount of water penetration of the whole hollow fiber falls. Moreover, if microfibril length is longer than 5 micrometers, the mechanical strengths of a compact layer tend to run short. Moreover, when microfibril spacing is larger than 0.3 micrometers, the fractionation engine performance of a hollow fiber tends to fall. In supporters, the average microfibril length has desirable 0.5-10 micrometers, and average microfibril spacing has desirable 0.1-0.6 micrometers. Microfibril length is less than 0.5 micrometers, or the amounts of water penetration of the whole hollow fiber run short that microfibril spacing is less than 0.1 micrometers. Moreover, if microfibril length is longer than 10 micrometers, whenever [after extension of a hollow fiber / breaking extension] tends to run short. Moreover, also when microfibril spacing is larger than 0.6 micrometers, mechanical strengths tend to run short.
[0023] Moreover, in a hollow fiber, if the compact layer which has small micropore from the supporters who have big micropore for a processed liquid is supplied, it will be hard to generate blinding. Usually, the OUT->IN filtration which supplies a processed liquid from the front face of a hollow fiber is more efficient. For this reason, if supporters are used as the outermost layer and a compact layer is arranged to this inner layer side, since supporters will be stationed at the supply side of a processed liquid, it will be hard to carry out blinding and will be desirable.
[0024] On the other hand, it is the compact layer which has rate-limiting ** of the amount of water penetration of a hollow fiber, and small micropore. Therefore, it is desirable, when the film surface product of a compact layer is enlarged as much as possible and the amount of water penetration is raised. For this reason, as for a compact layer, it is desirable by arranging to an outer layer side and enlarging that bore and outer diameter rather than the inner layer side of a hollow fiber, as much as possible, to enlarge a film surface product. Moreover, it is easy to become inadequate for the heat insulation effect of the hollow fiber itself at the time of manufacture of a hollow fiber cooling the inner layer side. For this reason, it is easy to crystallize a polymer chain, without fully receiving elongation stress (stress proportional to viscosity). If extension processing is performed to the basis of such disordered crystal orientation, since the micropore dimension after extension (especially microfibril spacing) becomes uneven in the thickness direction, it will be thought that the fractionation engine performance of a compact layer falls. In order to prevent such fractionation performance degradation, as for a compact layer, it is desirable to arrange to an outer layer side as much as possible, and to make it fully cooled.
[0025] Therefore, in this invention, it is suitable for a hollow fiber to consider as the structure of three or more layers which has stationed supporters in the innermost layer and the outermost layer, and has arranged the compact layer as an interlayer between these. Moreover, since the innermost layer and the outermost layer are supporters in this case, even if it supplies the either processed liquids of the front face of a hollow fiber, and an inside, blinding cannot happen easily. Furthermore, the role protected from the trauma which supporters deal with a compact layer and receive at the time or the time of filtration is also played by inserting into supporters as an interlayer the compact layer which is a detached core.
[0026] Moreover, as for the hollow fiber used for the art of the condensation of this invention, it is desirable to cover with a hydrophilic macromolecule and to make it be easy to get wet in water. That is, the pars tuberalis of the stacked lamellae of a hollow fiber and the front face of microfibril are covered with a hydrophilic macromolecule. If this hydrophilic processing is performed, as shown in drawing 3 , microfibril bands several [at a time] together, and serves as the microfibril bundle 21, and micropore 22 can consist ellipse-like of the shape of a slit, and can expand the average aperture of micropore 22.
[0027] In the hollow fiber which performed this hydrophilic processing, the magnitude of the micropore 22 of a compact layer is expressed by the mean distance Da between the microfibril bundles 21 (average aperture). And it is desirable that this Da is 0.2-0.5 micrometers, and it is more desirable that it is 0.3-0.4

micrometers. Especially in the hollow fiber which set said Da to 0.2 micrometers or more, the amount of water penetration is large, and when Da is 0.5 micrometers or less, the stopping-power force of a particle is good, and the hollow fiber which has the high fractionation engine performance can be obtained.
[0028] In the hollow fiber which performed hydrophilic processing, as for the magnitude of supporters' micropore 22, it is desirable that the mean distance Db between the microfibril bundles 21 shown in drawing 3 (average aperture) is 0.2-1 micrometer, and it is more desirable that it is 0.4-0.5 micrometers. In the hollow fiber in which Db has less than 0.2-micrometer supporters, when a water transmission rate falls and Db exceeds 1 micrometer, the film reinforcement of a hollow fiber falls.
[0029] Moreover, it is desirable that the ratio of Db and Da is 1.3 <=Db/Da<=4.0. When Db/Da is less than 1.3, the hollow fiber of the high fractionation engine performance and the high amount of water penetration may not be obtained. If Db/Da exceeds 4.0, since the physical-properties difference of the ingredient of the ingredient of a compact layer and supporters will be expanded, melt spinning or the stability in extension processing falls. Moreover, as for the mean distance Mb between the pars tuberalises of the stacked lamellae 18 in supporters, it is desirable that it is 0.4-4.0 micrometers, and it is more desirable that it is 0.7-2.0 micrometers. When Mb is less than 0.4 micrometers, a water transmission rate falls, and when Mb exceeds 4.0 micrometers, the film reinforcement of a hollow fiber falls.
[0030] By the way, the mean distances Da and Db between said microfibril bundles are the followings, and are made and measured. That is, from a hollow fiber, an ultra-thin intercept is cut down to fiber shaft orientations, it considers as a sample, and the part of 6cm angle of this sample is incorporated on the CRT screen of an image processing system from a 6500 times as many transmission electron microscope photograph as this. Drawing 4 is the mimetic diagram of this image. Subsequently, the scanning line from 1 Motome to n Motome is drawn in 0.052-micrometer pitch in this taking-in image in the direction which intersects perpendicularly with fiber shaft orientations. And the part shown by alpha in which all the range of one micropore has not fitted is excepted, and each distance of the segment which passes the part of micropore of 1 Motome's scanning lines, for example, the sum of a1 to a5, is found. Subsequently, similarly about 2 Motome's scanning line, it asks for the sum of b1 to b6, and total (distance total) is issued in quest of the sum of n1 to n6 of n Motome's scanning line one by one. Next, it asks for a number (with 1 Motome's scanning line, five and 2 Motome are six and n Motome is six) of micropore of total (number total) which each scanning line passed, and let distance total / number total be the average spacing Da and Db. The microfibril length L and the microfibril spacing W which are shown in drawing 2 can be measured similarly.
[0031] As for the bore of the hollow fiber used for the art of the condensation of this invention, it is desirable that it is the range of 50-5000 micrometers. In less than 50 micrometers, the pressure loss inside a hollow fiber becomes large, and a bore is inconvenient practically. Moreover, if it exceeds 5000 micrometers, the film surface product of a hollow fiber will fall and the amount of water penetration per unit volume will fall. As for all the thickness of a hollow fiber, it is desirable that it is 5-500 micrometers, and it is 30-200 micrometers more preferably. In less than 5 micrometers, film reinforcement may be weak and deformation may arise. Moreover, if 200 micrometers is surpassed, water permeability will fall.
[0032] As for the thickness of a compact layer, it is desirable that it is 0.5-20 micrometers, and it is more desirable that it is 3-12 micrometers. If it is it easy to generate a pinhole defect in a compact layer to be less than 0.5 micrometers and 20 micrometers is surpassed, the amount of water penetration of a hollow fiber will fall. Moreover, if it is desirable that it is 1/3 or less [of all the thickness of a hollow fiber] as for the thickness of a compact layer and it is thicker than this, in a hollow fiber, permeable high ability may become is hard to be obtained effectively. Moreover, supporters' thickness is thicker than the thickness of a compact layer, and it is desirable that supporters' much more thickness is 20-50 micrometers. When supporters are thinner than a compact layer, sufficient film reinforcement may not be obtained. Moreover, sufficient film reinforcement and the amount of water penetration may not be securable in it being less than 20 micrometers. If it exceeds 50 micrometers, the film surface product of a compact layer may be unable to be enlarged.

[0033] Moreover, as for the void content of a hollow fiber, it is desirable that it is more than 75vol%. A filtration life can be lengthened by making a void content more than 75vol%. Moreover, it is desirable that the maximum aperture of the micropore for which it asked by the bubble point method is 0.05-1.0 micrometers. When there is an inclination for a water penetration rate to fall when the maximum aperture is less than 0.05 micrometers and it exceeds 1.0 micrometers, film reinforcement may fall.
[0034] As polyolefines of the material which constitutes a hollow fiber, polyethylene, polypropylene, the Polly 3-methylbutene -1, the Polly 4-methyl pentene -1, polyvinylidene fluoride, etc. are mentioned, for example. These are independent or can be used as two or more sorts of mixture.
[0035] Polyolefine is ASTM. It is desirable that MI value (melt index value) measured by D-1238 is the range of 0.1-50g / 10min, and the range of 0.3-15g / 10min is more desirable. Since MI value of melt viscosity is too high, size enlargement is difficult for the polyolefine of 0.1g / 10min Suemitsu, and it is difficult to obtain a desired porous layer. Moreover, conversely, the polyolefine with which MI value exceeds 50g / 10min has too low melt viscosity, and is difficult to perform stable size enlargement. When using polyethylene, MI value is a measuring method by JISK6760, it is desirable that it is in the range of 0.05-20.0g / 10min, and it is the range of 0.1-5.0g / 10min more preferably. MI value of viscosity is very high in 0.05g / less than 10 min, and melt spinning becomes difficult. If 20.0g / 10min is exceeded, a crystal stacking tendency cannot become inadequate and uniform micropore structure cannot be acquired.
[0036] In the case of polyethylene, the consistency of polyolefine is 3 0.95g/cm, for example, although it changes with the classes. It is desirable still more desirable that it is above, and it is 3 0.960g/cm. It is above. In the case of polypropylene, it is 3 0.91g/cm. It is desirable that it is above. If a consistency is smaller than this, formation of the micropore by extension becomes uneven and it is inconvenient. A setup, a blend, etc. of polymerization conditions can adjust these consistencies or MI value freely. Moreover, the magnitude of the micropore of each class can be adjusted by using the polyolefine with which a consistency differs from MI value as an ingredient of a compact layer and supporters.
[0037] The hollow fiber of such a vesicular structure is the following, and can specifically be made and manufactured. That is, after being desirable temperature higher 10-100 degrees C than the melting point more than the melting point of polyolefine, extruding a melting polymer using the nozzle for hollow fiber manufacture which has three or more annular deliveries arranged by concentric circular and carrying out melt spinning, it cools in a 10-40-degree C ambient atmosphere, and rolls round at a 0.1-3m [/second] rolling-up rate, and a compact layer and supporters get compound the non-extended hollow fiber (non-extended yarn) by which the laminating was carried out. Then, it heat-treats at the temperature below the melting point of polyolefine, and desirable temperature lower 5-50 degrees C than the melting point, and stacked lamellae is made to form if needed. Subsequently, extension processing is performed and the hollow fiber of a vesicular structure is obtained. As for extension processing, it is desirable to perform two-step extension of the cold stretch performed at comparatively low temperature and the hot-rolling growth under heating.
[0038] By the cold stretch, destruction takes place to the crystal structure of non-extended yarn, and uniform and micro cracking (micro crack) occurs between stacked lamellaes. This cold stretch is 0 degrees C or more, and it is desirable to carry out in the range of temperature lower 50 degrees C than the melting point of polyolefine. For example, when polyethylene is used as polyolefine, let preferably 0-80 degrees C of this cold stretch temperature be the range of 10-50 degrees C. Moreover, 5 - 200% of a cold stretch scale factor is desirable. Less than 5% of generating of a micro crack is insufficient. Moreover, since deformation of stacked lamellae will take place and each void content of a compact layer and supporters will fall if it exceeds 200%, it is inconvenient.
[0039] Hot-rolling growth is a process used as the hollow fiber of the vesicular structure which is made to expand the micro crack which made it generate by the cold stretch, forms microfibril between stacked lamellaes, and has slit-like micropore. Hot-rolling growth temperature is the range which does not exceed the melting point of polyolefine, and it is desirable to carry out at the highest possible temperature. Although a hot-rolling growth scale factor can be suitably selected by the aperture of the micropore made into the purpose, it is desirable to consider as 100 - 1000% of range preferably in

respect of process stability 50 to 2000%. Then, it is desirable to carry out heat set processing of the obtained hollow fiber in the bottom of fixed-length or the condition of having made it loosening for a while, and to stabilize that dimension. Heat set temperature is beyond hot-rolling growth temperature, and is desirable. [of below the melting point temperature of thermoplastics]
[0040] Subsequently, hydrophilic processing is performed to this hollow fiber. After a hollow fiber is specifically immersed into the hydrophilic polymer solution which dissolved the hydrophilic giant molecule in the solvent, a solvent is evaporated through the setting processing and desiccation processing which are mentioned later, and the hollow fiber covered with the hydrophilic giant molecule is obtained.
[0041] as a hydrophilic giant molecule -- ethylene -- more than 20 mol % and a hydrophilic monomer -- more than 10 mol % -- the included copolymer may be desirable and any, such as a random copolymer, a block copolymer, and a graft copolymer, are sufficient as this copolymer. The ethylene content of compatibility is [as opposed to / at 20 mol % Suemitsu / a hollow fiber] weak, and the predetermined amount of covering is not obtained but it is inconvenient.
[0042] as a hydrophilic monomer -- vinyl compounds, such as vinyl alcohol, an acrylic acid (meta) or its salt, hydroxyethyl (meta) acrylate, polyethylene-glycol (meta) acrylic ester, vinyl pyrrolidone, and acrylamide, etc. -- it can raise -- these -- one sort -- or two or more sorts can be combined and it can use. Vinyl alcohol is suitable especially. Moreover, this hydrophilic giant molecule may contain the third components other than ethylene and a hydrophilic monomer more than a kind. As the third component, vinyl acetate, acrylic ester (meta), vinyl alcohol fatty acid ester, the FOMARU ghost of vinyl alcohol, or a butyral ghost can be raised, for example.
[0043] the amount of covering of the hollow fiber by the hydrophilic macromolecule -- 100 % of the weight (hollow fiber precursor) of hollow fibers before covering -- receiving -- 3 - 30% of the weight of the range -- it may be 3 - 15 % of the weight preferably. As for less than 3% of the weight of the case, a hydrophilic property is not fully acquired. If it exceeds 30 % of the weight, lock out of micropore etc. will become easy to take place with a hydrophilic macromolecule.
[0044] As a solvent of a hydrophilic macromolecule, a water miscibility organic solvent is desirable. As the example, alcohols, such as a methanol, ethanol, n-propanol, and isopropyl alcohol, dimethyl sulfoxide, dimethylformamide, etc. can be raised. Although these can be used even if they are independent, solubility [as opposed to a hydrophilic macromolecule in mixture with water] is large, and more desirable.
[0045] Moreover, especially the thing for which the mixed stock solvent which mixed alcohols of less than 100 degrees C of boiling points, for example, a methanol, ethanol, isopropyl alcohol, etc. and water is used from the lowness of the vapor pressure of the ease of making of the steamy content ambient atmosphere of a solvent at the time of drying a solvent, i.e., a solvent, and the point of low toxicity over the body is desirable. The mixed rate of an organic solvent and water does not check the permeability to a hollow fiber, but let it be the range in which the dissolution of a hydrophilic macromolecule is not reduced. Although it specifically changes with classes of hydrophilic macromolecule etc., when using ethanol, as for the rate of ethanol/water, it is desirable that it is the range of 90 / 10 - 30/70 (vol%).
[0046] Let preferably concentration of the hydrophilic macromolecule in a hydrophilic polymer solution be 0.5 - 5% of the weight of the range about 0.1 to 10% of the weight. At less than 0.1 % of the weight, if it is difficult to perform uniform covering of a hydrophilic macromolecule and it exceeds 10 % of the weight, solution viscosity becomes large too much, and the micropore of a hollow fiber may be blockaded with a hydrophilic macromolecule. A hollow fiber can be set to a hydrophilic polymer solution being immersed, and it can also be immersed in the solution of the same concentration twice or more, and can also be immersed in the solution with which concentration differs twice or more. It falls, a hydrophilic polymer solution tends to permeate a hollow fiber, and the viscosity of a hydrophilic polymer solution is so desirable that the temperature of the hydrophilic polymer solution in the case of immersion is high. However, it is desirable that it is below the boiling point of a safety aspect to an organic solvent. Although immersion time amount changes with the thickness of a hollow fiber, the diameter of micropore, and void contents, it is desirable to consider as the range for several seconds -

several minutes.

[0047] Before performing desiccation processing, it is [after being immersed in a hydrophilic polymer solution] desirable when setting processing is performed. The purpose of setting processing is to adjust the vapor rate of a solvent, in order to equalize covering by the hydrophilic macromolecule, while preventing micropore blockading by the coat of a hydrophilic macromolecule. setting processing -- the steam of an organic solvent -- more than 3vol% -- it is in the included condition which pulled up and started the hollow fiber immersed in the immersion bath in the ambient atmosphere of the temperature below the boiling point of an organic solvent beyond the room temperature, and is carried out by making it stay more than for at least 30 seconds.

[0048] In order to prevent that the coat of a hydrophilic macromolecule is formed on the surface of a hollow fiber, it is necessary to prevent the rapid desiccation on the front face of a hollow fiber. for this reason -- being alike -- it is required to maintain at the condition that made late the vapor rate of the solvent of the front face of a hollow fiber, and the front face of a hollow fiber has got wet with the solvent. For this reason, the ambient atmosphere of setting processing can attain the purpose, when it is more desirable to consider as the ambient atmosphere near the saturated steam concentration of a solvent and the steam of an organic solvent considers as the ambient atmosphere beyond 3vol%. Although it is better to make temperature of setting processing into low temperature in order to make late the vapor rate of the solvent from a hollow fiber, if too low, desolventization-ization does not progress but it is inconvenient. For this reason, when temperature of an ambient atmosphere is made into beyond a room temperature and below the boiling point of a solvent, it is desirable.

[0049] In setting processing, the include angle of starting when pulling up a hollow fiber from an immersion bath, and rising in said ambient atmosphere has the desirable range of 45 degrees - 90 degrees. By rising, some hydrophilic polymer solutions adhering to a hollow fiber are deliquored by self-weight. This amount of deliquoring changes with the rate at the time of pulling up a hollow fiber, the viscosity of a hydrophilic polymer solution, height that a hollow fiber starts. At this time, the hydrophilic polymer solution of the front face of a hollow fiber can also be wiped off by the guide, a slit, etc.

[0050] Setting time is made into 30 seconds or more. Concentration of a solvent is inadequate in less than 30 seconds, micropore may blockade or un-arranging [of being unable to cover to homogeneity] may occur. As for the evaporation of the solvent from a hollow fiber at the time of making time amount of setting processing into 30 seconds, it is desirable that it is about 15 - 30% of a hydrophilic polymer solution. As an approach of controlling the evaporation of a solvent, temperature is changed or the approach of ventilating gases, such as air and inert gas, into an ambient atmosphere etc. can be raised.

[0051] Subsequently, the hollow fiber which ended setting processing in the ambient atmosphere adjusted to predetermined temperature and a pressure is supplied, it dries, and it rolls round and the hollow fiber covered with the hydrophilic macromolecule is obtained. Since contraction of a hollow fiber occurs by desiccation at this time, it is desirable, when a part for that contraction is considered and the speed of supply of a hollow fiber is made larger than a winding rate. If a speed of supply and a winding rate are made equal, a hollow fiber will be pulled by contraction of a hollow fiber and it will be processed under high tension by it. For this reason, slit-like micropore may not become ellipse-like and sufficient permeable ability may not improve. However, if a speed of supply is too early, since yarn sag will occur before desiccation and process stability will fall to a winding rate, it is desirable when it adjusts suitably according to the contraction condition of a hollow fiber.

[0052] Desiccation processing can use the well-known desiccation approaches, such as a vacuum drying and hot air drying. Drying temperature is made into the temperature which does not deform a hollow fiber with heat. For example, it is desirable to dry at the temperature of 120 degrees C or less in the case of the hollow fiber made from polyethylene, and especially the thing to dry at the temperature which is 40-70 degrees C is desirable. Although the drying time changes with the average aperture of micropore, thickness, processing speed, etc., the hollow fiber should just be drying it enough in about 10 minutes from 1 minute. The final amount of covering of a hydrophilic giant molecule can be adjusted by setting up suitably the concentration of a hydrophilic polymer solution, the conditions of setting processing and desiccation processing, etc.

[0053] In the art of the condensation of this invention a compound fine porosity hollow fiber Although it may install in what kind of location of the path through which condensation circulates and condensation may be filtered with the gestalt of the module of the configuration of arbitration It is effective the path which results in the back boiler by which heating by the heater was performed preferably, and to filter condensation, just before resulting to the feed pump of a boiler more preferably, when preventing deposition on the feed pump aerofoils of a clad, the sediment to a water supply straightening vane, and the sediment into a boiler tube.

[0054]

[Example] Hereafter, the example of manufacture explains in more detail the compound fine porosity hollow fiber for hollow fiber modules used for the art of the condensation of this invention. In addition, the various measurement in the example of manufacture and evaluation were based on the following approach.

[0055] The ethanol concentration in an ambient atmosphere was measured using the gas detector (a gas tech indicator tube, a trade name, gas tech incorporated company make). The amount of covering of a hydrophilic copolymer was computed according to the following formula (1).

[0056]

Dry weight x100 of (the dry weight of the dry weight-hollow fiber precursor of the hollow fiber after hydrophilization processing) / hollow fiber precursor ... (1)

[0057] The void content of a hollow fiber was measured using the mercury-porosimeter 221 mold made from cull ROERUBA. The amount of water penetration of a hollow fiber is 2 70-90cm of effective film surface products. The mini module was created, it is 1kg/cm2 of differential pressure (98kPa), ion exchange water with a water temperature of 25 degrees C was filtered, and the amount of water penetration at that time was measured. For the fractionation particle diameter of a hollow fiber, a film surface product is 2 about 50cm. The processed liquid which distributed the polystyrene latex particle of predetermined particle diameter in the 0.1wt(s)% surface-active-agent (polyethylene-glycol-p-iso octyl phenyl ether) solution was filtered by the module of a hollow fiber, the concentration of the latex particle of filtrate was measured on the wavelength of 320nm with the Hitachi spectrophotometer (U-3400), and it asked for the particle diameter in 90% of rates of prehension.

[0058] (Example 1 of manufacture) The nozzle for hollow filament manufacture which has the delivery of the three shape of a tube arranged concentric circular was prepared. Consistency 0.966 g/cm3 which forms supporters in the delivery of the innermost layer of this nozzle, and the outermost layer, The melting polymer of the high density polyethylene (SANYO ENGINEERING & CONSTRUCTION HD-B161, Asahi Chemical Industry Co., Ltd. make) of MI value of 1.35g / 10min is supplied. The melting polymer of the high density polyethylene (the NIPORON hardware 5110, TOSOH CORP. make) of consistency 0.960 g/cm3 which forms a compact layer in an interlayer's delivery, and MI value of 0.9g / 10min was supplied and extruded, and melt spinning of the polyethylene hollow filament of 3 layer structure was carried out. At this time, the discharge temperature could be 170 degrees C. moreover, the discharge quantity of an innermost layer -- in the discharge quantity of 3.2 cc/min and an interlayer, 4.9/1/4.9 and regurgitation linear velocity were set into 6.1 cm/min, and draft ratio set the discharge quantity ratio of 0.65 cc/min, an innermost layer, an interlayer, and the outermost layer to 979 for the discharge quantity of 3.2 cc/min and the outermost layer.

[0059] Subsequently, hitting the temperature of 21 degrees C, and the cooling wind of 1m/second of wind speeds to the yarn made to breathe out from a nozzle to the perimeter at homogeneity, it rolled round in winding rate 60 m/min, and non-extended yarn (polyethylene multilayer object) was obtained. It heat-treated for 16 hours in the state fixed-length in the inside of the air which heated the obtained non-extended yarn at 115 degrees C. Furthermore, the cold stretch of this non-extended yarn was carried out 60% between the rollers kept at 30 degrees C, and hot-rolling growth was performed so that the total amount of extensions might become 550% in a 111-degree C heating furnace succeedingly. At this time, heat deformation velocity was taken as 1.3-/min. In the state fixed-length in the inside of a 120 more-degree C heating furnace, the heat set was performed and the compound fine porosity hollow fiber precursor (it is written as a hollow fiber precursor below) was obtained.

[0060] Next, the hydrophilic copolymer solution which dissolved the ethylene content % of ethylene-vinylalcohol copolymer of 32 mols (SOANORU DC 3203, the Japan synthetic chemistry incorporated company make) in 70-degree C ethanol / water mixed solution (mixing ratio 60/40vol%) 1.0% of the weight was adjusted. After the hollow fiber precursor obtained in this hydrophilic copolymer solution was immersed for 500 seconds, it was failed to extract some hydrophilic copolymer solutions which adhered to the front face superfluously with a pull-up and a guide. Then, after having risen in the 60-degree C ambient atmosphere, having risen at the include angle of 90 degrees, making it stay for 500 seconds and making the minute hole internal surface of a hollow fiber precursor carry out homogeneity adhesion of the hydrophilic copolymer ethanol steamy concentration 40vol%, the solvent was dried, making it overfeed 10% in 70-degree C hot blast. The amount of covering of the ethylene-vinylalcohol copolymer to the hollow fiber precursor of the obtained hydrophilization hollow fiber was 10.9 % of the weight. The film property of the obtained compound fine porosity hollow fiber (three-layer bipolar membrane whose interlayer is a compact layer) was shown in Table 1.

[0061] (Example 1 of comparison manufacture) The nozzle for hollow filament manufacture which has the delivery of the two shape of a tube arranged concentric circular was prepared. The high density polyethylene (SANYO ENGINEERING & CONSTRUCTION HD-B161, Asahi Chemical Industry Co., Ltd. make) of consistency 0.966 g/cm3 which forms a compact layer in the delivery of an outer layer for the melting polymer of the high density polyethylene (the NIPORON hardware 5110, TOSOH CORP. make) of 3 and MI value 0.9 g/min, and MI value 1.35 g/min was supplied and extruded the consistency of 0.960g/cm which forms supporters in the delivery of the inner layer of this nozzle, and melt spinning of the polyethylene hollow filament of the two-layer structure was carried out. At this time, the discharge temperature could be 170 degrees C. Moreover, in the discharge quantity of 1.3 cc/min and an outer layer, 1/7.7 and regurgitation linear velocity were set into 14.3 cm/min, and draft ratio set the discharge quantity ratio of 10.1 cc/min, a inner layer, and an outer layer to 714 for the discharge quantity of a inner layer.

[0062] Subsequently, it rolled round in winding rate 102 m/min, hitting the temperature of 21 degrees C, and the cooling wind of 1m/second of wind speeds to the yarn made to breathe out from a nozzle to the perimeter at homogeneity, and non-extended yarn (polyethylene multilayer object) was obtained. It heat-treated for 16 hours in the state fixed-length in the inside of the air which heated the obtained non-extended yarn at 115 degrees C. Furthermore, the cold stretch of this non-extended yarn was carried out 60% between the rollers kept at 30 degrees C, and hot-rolling growth was performed so that the total amount of extensions might become 600% in a 111-degree C heating furnace succeedingly. At this time, heat deformation velocity was taken as 1.1-/min. In the state fixed-length in the inside of a 120 more-degree C heating furnace, the heat set was performed and the hollow fiber precursor was obtained.

[0063] Next, the hydrophilic copolymer solution which dissolved the ethylene content % of ethylene-vinylalcohol copolymer of 32 mols (SOANORU DC 3203, the Japan synthetic chemistry incorporated company make) in 70-degree C ethanol / water mixed solution (mixing ratio 60/40vol%) 1.0% of the weight was adjusted. After the above-mentioned hollow fiber precursor was immersed for 500 seconds into this hydrophilic copolymer solution, a hollow fiber precursor is pulled up and it was failed to extract some hydrophilic copolymer solutions which adhered to the front face superfluously with a guide. Then, after having risen in the 60-degree C ambient atmosphere, having risen at the include angle of 90 degrees, making it stay for 500 seconds and making the minute hole internal surface of a hollow fiber precursor carry out homogeneity adhesion of the hydrophilic copolymer ethanol steamy concentration 40vol%, the solvent was dried, making it overfeed 10% in 70-degree C hot blast. The amount of covering of the ethylene-vinylalcohol copolymer to the hollow fiber precursor of the obtained hydrophilization hollow fiber was 10.5 % of the weight. The film property of the obtained compound fine porosity hollow fiber (bilayer bipolar membrane whose inner layer is a compact layer) was shown in Table 1.

[0064] (Example 2 of comparison manufacture) The nozzle for hollow filament manufacture which has the delivery of the shape of one tube was prepared. From this nozzle, melt spinning of the melting polymer used for the interlayer (compact layer) in the example 1 of manufacture was extruded and carried out by 2.8g of discharge quantity, and min. At this time, the discharge temperature considered as 170 degrees C, and was rolled round at the winding rate of 35 m/min. On the same conditions as the example 1 of manufacture, it heat-treated and extension-processed, hydrophilization processing of the obtained non-extended yarn was carried out, and the hydrophilization hollow fiber was obtained. The amount of covering of the ethylene-vinylalcohol copolymer to the hollow fiber precursor of the obtained hydrophilization hollow fiber was 8.0 % of the weight. The film property of the obtained fine porosity hollow fiber (homogeneous membrane) was shown in Table 1.

[0065]

[Table 1]

	外径 (μm)	膜厚(μm)		空孔率 (%)	透水量 (※1)	分画粒子径 (μm)
		全膜厚	緻密層			
製造例1 (緻密層中間層膜)	395	70	10	77	33.7	0.230
比較製造例1 (緻密層内層膜)	388	68	11	77	30.6	0.230
比較製造例2 (均一膜)	410	70	–	69	25.1	0.230

(※1：L/m^2·hr·kPa at25℃)

[0066] (An example 1 and examples 1 and 2 of a comparison) The hollow fiber module of the same configuration as what used various kinds of compound fine porosity hollow fibers and fine porosity hollow fibers which were created in the example 1 of manufacture and the examples 1 and 2 of comparison manufacture, and showed them to drawing 1 mentioned above was created. While the concentration of a clad (80% of amorphous iron, alpha-Fe 2O3 20%) filtered condensation simulation liquid of 100ppb with 40 degrees C and the external pressure of 0.5kg/cm2 (49kPa) using these hollow fiber modules, scrubbing which applies air bubbles from a modular lower part, and functional recovery which performs a pressurization back wash to coincidence were carried out weekly. The differential pressure and the amount of water penetration immediately after functional recovery 50 days after were measured in the initial differential pressure of the hollow fiber module in this trial and the amount of initial water penetration, and the list, and that result was shown in Table 2.

[0067]

[Table 2]

	中空糸膜	透水量（L/m^2·hr·kPa）	
		初期	50日後
実施例1	製造例1 (緻密層中間層膜)	36.8	35.7
比較例1	比較製造例1 (緻密層内層膜)	33.2	31.5
比較例2	比較製造例2 (均一膜)	27.1	24.4

[0068] As shown in Table 2, as compared with the compact layer inner layer-ized bipolar membrane (and homogeneous membrane) in which the hollow fiber module using the hollow fiber of 3 layer structures which made the middle class the compact layer shown in the example 1 has the same fractionation of the examples 1 and 2 of a comparison, the amount of water penetration was large, and it is hard to carry out blinding, and the good result was obtained.

[0069]

[Effect of the Invention] As explained above, the hollow fiber used for the art of the condensation of this invention It comes to carry out the three or more layer laminating of the film of the three-dimensional structure made from polyolefine which has two or more micropores formed of the microfibril combined with stacked lamellae and this stacked lamellae. Since the innermost layer and outermost layer are supporters and the interlayer inserted among these is the compound fine porosity hollow fiber which is a compact layer with an average aperture smaller than supporters' micropore In OUT->IN filtration, the conventional compact layer can earn the film surface product of the film outside surface of a precise layer, and the flux (permeable ability) rise of it is attained from the hollow fiber located in an innermost layer. Therefore, the increment in the further amount of water penetration can be aimed at, blinding-proof nature being excellent and maintaining long lasting and endurance compared with the conventional hollow fiber. Moreover, in the amount filtration of steady flow, the processing pressure force is low, from back wash recoverability being excellent, stable operation is possible over a long period of time [stable], and a higher filtration efficiency can be maintained over a long period of time. Moreover, in pressure filtration, even if it uses it in the amount of high water penetration, it is hard to produce fixing unification of a hollow fiber, and the fall of the amount of water penetration with time is excellent also in endurance few. Moreover, since the higher amount of water penetration can be obtained maintaining the high fractionation engine performance made into the purposes, such as full removal of a clad, as compared with the case where the conventional hollow fiber with the same fractionation engine performance is used, use **** can be reduced, consequently miniaturization of a hollow fiber module can also be attained.

[0070] Therefore, if it is in the art of the condensation of this invention using such a hollow fiber, quantity of water to be treated can be large, the purification engine performance of condensation can be good, and there can be little aging of quantity of water to be treated, and it is stabilized for a long period of time, and can operate, and can process by space-saving. Moreover, since polyolefine is used for the hollow fiber, the trash generated after processing of condensation can be incinerated and can control generating of secondary trash.

[0071] Moreover, since sufficient film reinforcement and the amount of water penetration can be secured and the film surface product of a compact layer can be enlarged by making said supporters thicker than a compact layer, and setting these supporters' much more thickness to 20-50 micrometers, the quantity of water to be treated of condensation can be made to increase further. Moreover, by making the void content of the whole film of said hollow fiber more than 75vol%, since a filtration life can be lengthened, it is stabilized further for a long period of time, and condensation can be processed. Moreover, since hydrophilization processing can be performed to said hollow fiber, two or more can band microfibril at a time together, the average aperture of micropore can enlarge by making micropore into the shape of an ellipse from the shape of a slit and the amount of water penetration can enlarge, the quantity of water to be treated of condensation can be made to increase further.

[0072] Moreover, by making the amount of covering by said hydrophilic macromolecule into 3 - 30 % of the weight to the hollow fiber before covering, since a hydrophilic property is fully acquired and lock out of the micropore of a hollow fiber etc. stops being able to happen easily, it is stabilized further for a long period of time, and condensation can be processed. moreover, a ratio with the mean distance Db between supporters' microfibril bundles over the mean distance Da between the microfibril bundles of the compact layer after covering -- Db/Da by making it the range of 1.3-4.0 and it can raise the purification engine performance of condensation further and can also make quantity of water to be treated increase further, since the hollow fiber of the high fractionation engine performance and the high amount of water penetration can be obtained The hollow fiber contained in this the hollow fiber module for condensation processing of this invention Stacked lamellae, It comes to carry out the three or more layer laminating of the film of the three-dimensional structure made from polyolefine which has two or more micropores formed of the microfibril combined with this stacked lamellae. The innermost layer and outermost layer are supporters, and since the average aperture of micropore is a compact layer smaller than the average aperture of supporters' micropore, the interlayer inserted among these has permeable ability and the high fractionation engine performance, and cannot do blinding easily, and it becomes the thing excellent in a mechanical strength and endurance. Such a hollow fiber is suitable for processing of condensation.

[Translation done.]

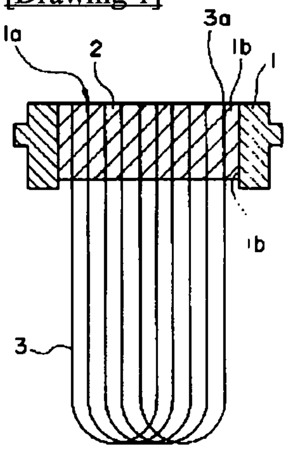
* NOTICES *

JPO and NCIPI are not responsible for any damages caused by the use of this translation.

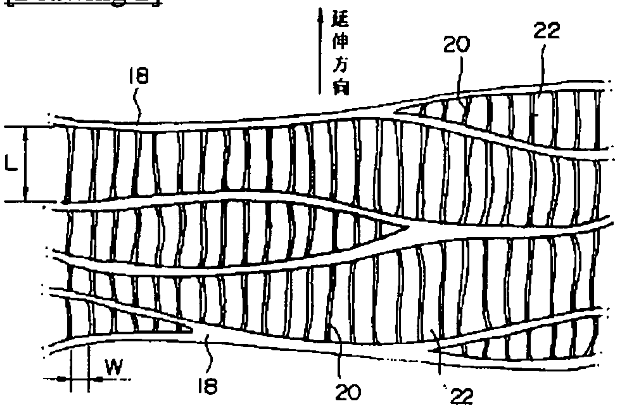
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

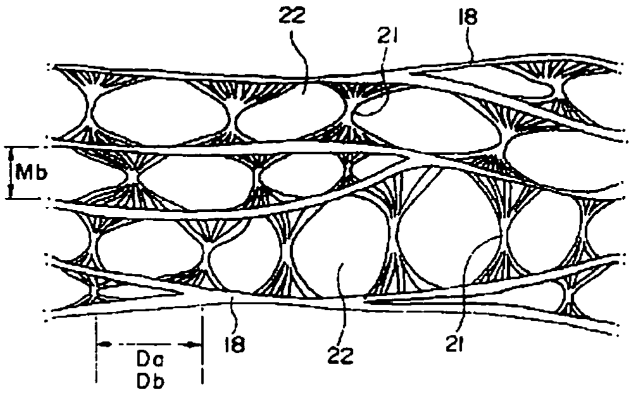
[Drawing 1]



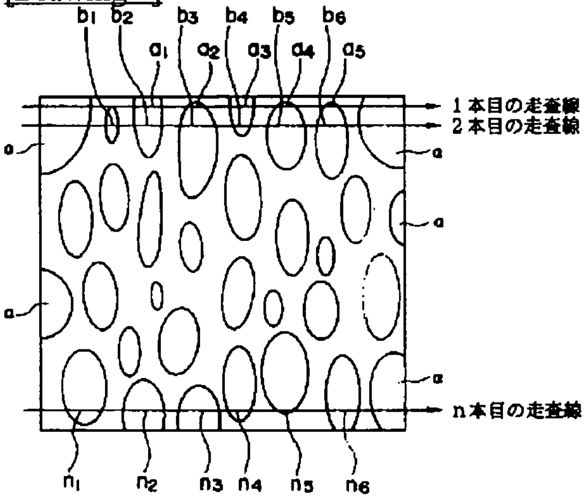
[Drawing 2]



[Drawing 3]



[Drawing 4]



[Translation done.]